The horizontal dilation is trickier. Each value of the argument must be 5 times what it was in the pre-image to generate the same y-values. Substitute v for the argument of f.

$y = f(v)$	Let v represent the original x-values.
$x = 5v$	The x-values of the dilated image must be 5 times the x-values of the pre-image.
$\frac{1}{5}x = v$	Solve for v.
$y = f\left(\frac{1}{5}x\right)$	Replace v with $\frac{1}{5}x$ for the argument to obtain the equation of the dilated image.

Figure 1-3c shows the graph of the image, $y = f\left(\frac{1}{5}x\right)$

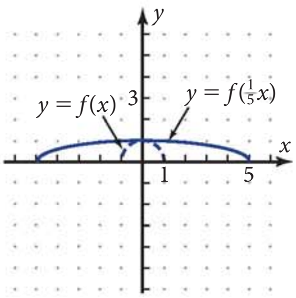

Figure 1-3c

Putting the two transformations together gives the equation for $g(x)$ shown in Figure 1-3a.

$$g(x) = 3f\left(\frac{1}{5}x\right)$$

EXAMPLE 1 ➤ The equation of the pre-image function in Figure 1-3a is $f(x) = \sqrt{1 - x^2}$. Confirm on your grapher that $g(x) = 3f\left(\frac{1}{5}x\right)$ is the transformed image function

a. By direct substitution into the equation

b. By using the grapher's built-in variables feature

SOLUTION

a. $g(x) = 3\sqrt{1 - (x/5)^2}$ — Substitute $x/5$ as the argument of f, and multiply the entire expression by 3.

Enter: $f_1(x) = \sqrt{1 - x^2}$

$f_2(x) = 3\sqrt{1 - (x/5)^2}$

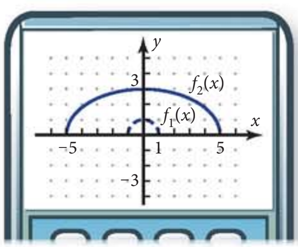

Figure 1-3d

The graph in Figure 1-3d shows a dilation by 5 in the x-direction and by 3 in the y-direction. Use the grid-on feature to make the grid points appear. Use equal scales on the two axes so the graphs have the correct proportions.

b. Enter: $f_3(x) = 3f_1(x/5)$ — f_1 is the function *name* in this format, not the function value.

This graph is the same as the graph of $f_2(x)$ in Figure 1-3d. ◄